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METALLIC MINERALS IN ALBERTA

Alberta
ENERGY AND
NATURAL RESOURCES
Mineral Resources

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Preface

Alberta has potential for discovery of metallic minerals which has not yet been fully explored. The province has a wide variety of geological terrain which could contain metallic minerals. The Government of Alberta wishes to support development of this untapped resource by providing extensive support services and by establishing tenure and royalty regulations encouraging mining development.

This publication is for individual prospectors, prospecting associations and companies actively involved in exploring for and developing metallic minerals. It is produced by Alberta Energy and Natural Resources in co-operation with the Alberta Chamber of Resources.

It is hoped this publication will help those in the mining industry to examine the potential for successful metallic mineral exploration and development in Alberta.

The information contained in this publication is of an explanatory nature. The applicable legislation in numerous acts and regulations remains the final authority for any administrative and regulatory procedure.

Alberta Geological Survey crew during mapping project.

Introduction

Alberta is well known for its natural resources such as oil, natural gas, oil sands, coal and industrial minerals. At present, however, there is no active development of metallic minerals.

This publication will serve as a source of information for the mining industry and individual prospectors to plan metallic minerals exploration and development efforts in the province.

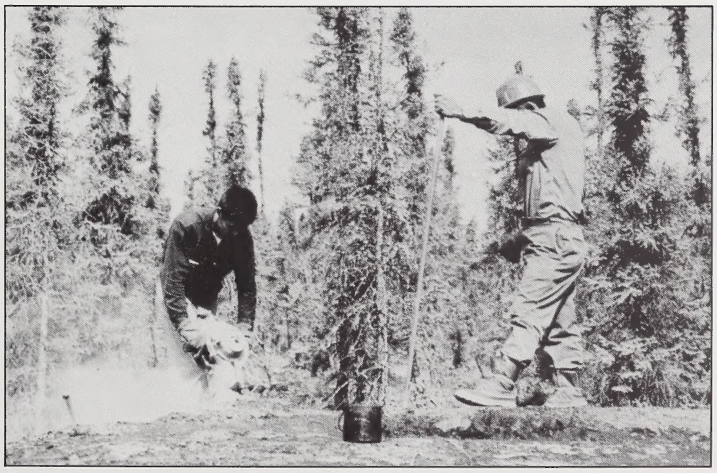
Chapter 1 briefly describes the geology of Alberta and points out potential areas for successful exploration and development. The history of metallic minerals mining in Alberta is also briefly described.

Chapter 2 describes many support services in the areas of geological mapping and geophysical research maintained by Energy and Natural Resources. These services are outlined and information given on ways to access them.

Chapter 3 describes provincial government legislation and regulatory procedures that affect the mining industry. This is particularly relevant since new legislation for metallic minerals was passed in 1984, and new legislation for royalties was passed in 1985.

Chapters 3, 4, 5 and 6 outline regulatory procedures required for exploration, acquisition of mineral rights and development of metallic minerals.

Chapter 7 describes the importance and roles of land-use administration and environmental protection in the administration of metallic minerals regulations.



Exploration crew prospecting Athabasca Basin in Northeastern Alberta.

Digitized by the Internet Archive
in 2016

https://archive.org/details/metallicminerals00albe

1. Geology

Alberta's varied geological terrain offers potential for metallic minerals exploration and development. Chapter 1 identifies the types of metallic minerals discussed in this publication and briefly describes the geology and mining history of the province.

Precambrian Shield outcrop in Northeastern Alberta.

1.1 Definition of Metallic Minerals

For administrative purposes all minerals which belong to the Crown in right of Alberta are metallic for the purposes of the Mines and Minerals Act, except for placer minerals as defined in the Placer Mining Regulation (Alta. Reg. 41/81), coal, petroleum, natural gas and oil sands, quarriable minerals and any mineral extracted in salt form.

In Alberta the metallic minerals which may occur are sulfides, sulfosalts, oxides and native elements.

1.2 Geological Potential

The geological terrain of Alberta has three distinctive parts, each with specific geological potential: the Precambrian Shield, the Western Sedimentary Basin and the Eastern Slopes of the Cordillera (Figure 1).

The highest potential for successful exploration of metallic minerals occurs in northern Alberta which is underlain by rocks of the Churchill Province of the Precambrian Shield. The Proterozoic Athabasca Sandstone Basin in northeastern Alberta overlaps the crystalline basement complex with profound unconformity. To the west, the Paleozoic limestones overlap the Shield with marked unconformity just west of the Slave River.

With the discoveries of the unconformity-type uranium deposits in Saskatchewan, the Athabasca Basin has become the centre of much economic interest; however, no economic deposits have been found in Alberta, where exploration continues.

There were several exploration projects for copper along the foothills in the southwestern part of the province in the early 1900s and 1960s. In the early 1970s there was extensive exploration and metallurgical research of iron-bearing sandstone deposits in the Clear Hills area of northwestern Alberta.

Although data are sparse, the potential for Mississippi-Valley-type lead-zinc deposits in northern Alberta is considered to be high. Formational equivalency in geologic continuity, with a world-class mine only 100 kilometres north of Alberta's border and reported showings of lead-zinc mineralization in cores and outcrops, makes this an area worthy of further investigation.

1.3 History of Metallic Minerals Mining and Exploration in Alberta

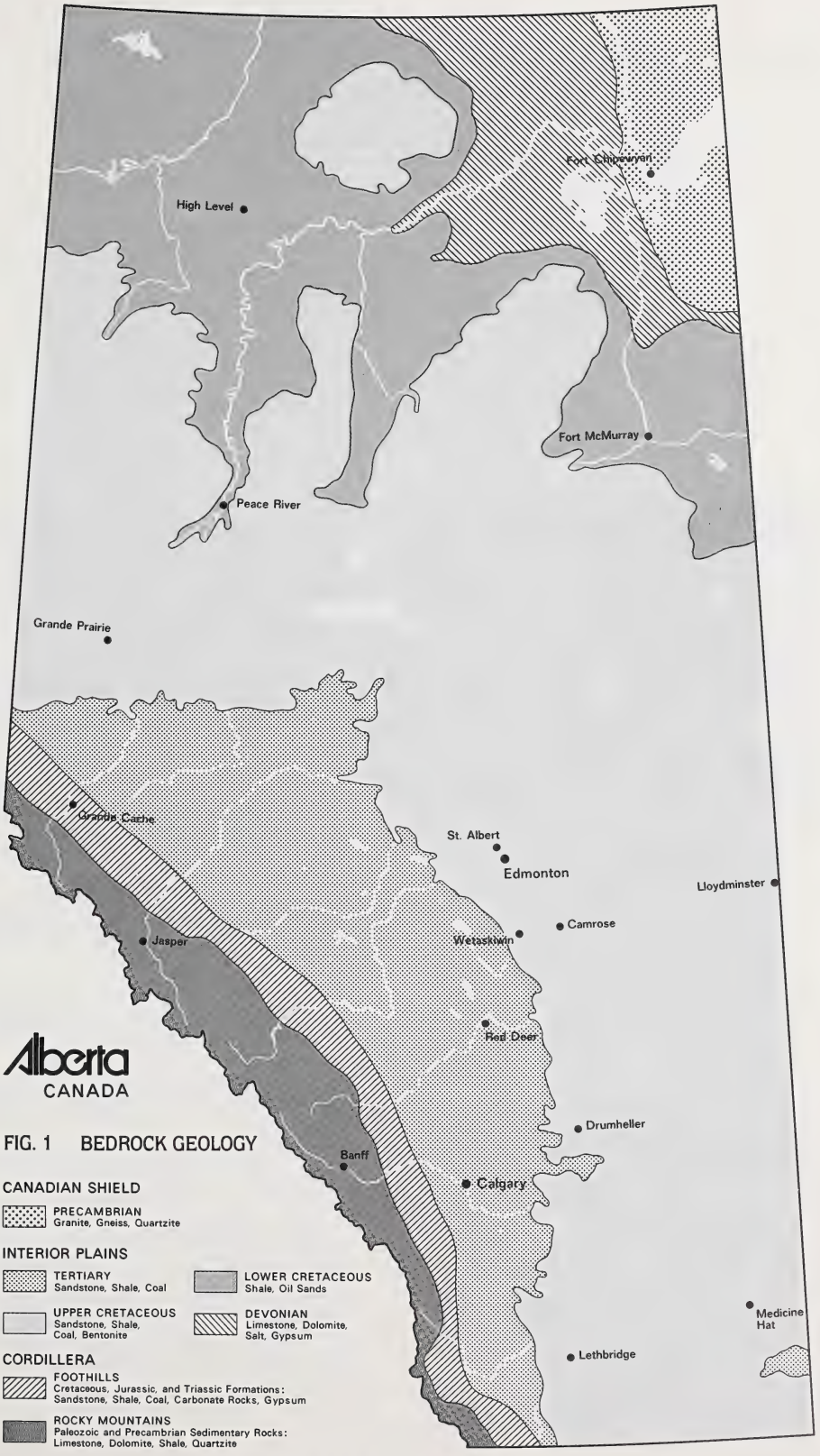
Alberta is known as a resource-rich province; however, no metallic minerals mines are part of the resource industry in Alberta today.

The mining of metallic minerals in Alberta began in the last century. The first mining town, Silver City, was established in 1881, 30 kilometres west of Banff, after copper mineralization with a small percentage of silver was found. A large number of claims were staked in the vicinity and three mines were started near the town. The mine workings together with local geology have been described in the *Geological Survey of Canada Annual Report,* Volume 1, 1885 by G.M. Danson. Because no economically viable deposits were found, the mining town was torn down in the years 1886 to 1888. The miners left for other more prosperous locations such as Golden, British Columbia, although some mining claims were held by companies until the 1970s.

The old workings were rejuvenated during the First World War and several copper mines operated until the early 1920s within the boundaries of Banff National Park. One mine was operated by the Eldon Mining Company, another by the Calgary Copper Company and the Sarra Mine was operated by an American company. There was also a mine operating somewhere within today's Waterton National Park.

Exploration for copper continued into the late 1960s in an area north of Waterton National Park and minor exploration for lead-zinc mineralization was carried out in an area north of Crowsnest Pass.

Abandoned workings of Eldon Mine.



Produced by the Alberta Bureau of Surveying and Mapping © 1983

2. Government Services

The Government of Alberta provides many services to support metallic minerals exploration and development. These services include geological research and mapping, geoscience information collection and core storage. Prospectors and mining companies are encouraged to use these services.

The following sections describe the services available and give contacts within the department for more information.

2.1 Services of the Alberta Geological Survey

The Alberta Geological Survey is a department of the Natural Resources Division of the Alberta Research Council, a provincial Crown corporation dedicated to promoting the economic development of Alberta through science and technology. Founded in 1921 and currently employing over 500 staff, the Alberta Research Council is the oldest and largest provincially sponsored research organization in Canada.

The survey is involved in three types of activities:

1) geological surveys, which involve mapping the surface and subsurface geology of the province and compiling earth resource inventories
2) research, with emphasis on applied research on strata and deposits of actual or potential economic interest, but also including a measure of basic research
3) information and advisory services in the form of publications, conference presentations, courses, seminars, consultations and responses to inquiries

The offices of the Alberta Geological Survey are located in:

Terrace Plaza
4445 Calgary Trail South
Edmonton, Alberta, Canada
T6H 5R7

The main laboratory facilities will be located in the spring of 1986 in the newly built Alberta Research Council Centre at:

250 Karl Clark Road
Box 8330, Station F
Edmonton, Alberta, Canada
T6H 5X2

The facility will include a sedimentation laboratory (oil extractions, grain size analysis, thin sections, etc.), an X-ray laboratory (preparation and diffraction), a ceramics laboratory (clay firing), a palynology laboratory (separation and mounting), and a Quaternary laboratory (gravel and till analyses). A scanning electron microscope, computing services and a machine shop will also be there.

2.2 Geological Research and Mapping

Metallic mineral resources research done by the Alberta Geological Survey includes geological survey mapping and resource inventory assessment of virtually all of the economically important rocks of Alberta, from the Precambrian Shield of northeastern Alberta, through the Parklands and Plains to the mountains.

In recent years geological investigation and research for metallic mineral deposits have been continued in two major projects.

The first project, to map 11 000 km^2 of the Precambrian Shield in northeastern Alberta, is completed. Fourteen of ARC's geological reports describe the Shield and are accompanied by the 36 geological maps at a scale of 1:31 680. The mapping project has generated a huge data base, including geochemical and geophysical data (Figure 2).

Airborne geophysical survey aircraft over Athabasca Basin.

The project results, published in numerous ARC Bulletins, describe polyphase deformation in the Canadian Shield of northeastern Alberta and summarize the structural geology of the exposed Precambrian Shield of northeastern Alberta. The successive phases of deformation are put into a temporal framework based on geochronological studies. Precambrian Shield geochemistry was also studied in 1983 and 1984 with 660 sample analyses by wet-chemical and XRF techniques for major and trace elements. This data is stored in ARC's computer disc files along with modal analyses for each sample.

The second project was a geological study (presented in ARC Bulletin #49) of the Alberta portion of the Athabasca Basin. The Athabasca Basin study established a stratigraphic framework for the Athabasca Group in Alberta and identified variances from the Saskatchewan succession where major deposits of uranium are found.

2.3 Geophysical Surveys in Alberta

2.3.1 Airborne Magnetic Surveys

Northeastern Alberta, north of 53°N and east of 114°W, was surveyed in 1952 for the then Canada Department of Mines and Technical Surveys.

The area was flown at a flight altitude of 300 metres above ground level with flightlines flown east-west with 1.6-km spacing intervals, and 46 lines flown north-south at an interval of 20 km, data collected with 1 nanotelsa (nt) precision. The aeromagnetic compilation was carried out on base maps at a scale of 1:40 000 without corrections for regional variation and the total magnetic field was contoured by hand with 10 nt units.

Two series of maps are available, one at a scale of 1:63 360 and one at a scale of 1:250 000 (composite map).

The maps may be used for basic lithological interpretation of basement rock, techtonic lineation interpretation and calculation of thickness of sedimentary cover.

2.3.2 Airborne Gamma Ray Spectrometry Survey Data

Northeastern Alberta, north of 57°30'N and east of 114°W, was surveyed in 1978 for the Canada Department of Energy, Mines and Resources.

The survey is presented as contour maps of total count, potassium, equivalent uranium and equivalent thorium counts and eU/eTh, eu/K and 6Th/K ratios and in stacked profiles of all the above parameters for each of the east-west flights lines flown at 5-km spacing.

Geophysical maps under 2.3.1 and 2.3.2 are available from:

Publication and Air Photo Section
Institute of Sedimentary and
Petroleum Geology
3303 - 33 Street N.W.
Calgary, Alberta, Canada
T2L 2A7

2.4 Bibliography of Geological Maps and Associated Reports

2.4.1. Maps

Number on Index Map Fig. 2:

1. Geology of Andrew Lake, North District, Alberta; John D. Godfrey, 1961., Scale 1:31 680. Accompanies Earth Sciences Report 58-3. (NTS 74M)
2. Geology of Andrew Lake, South District; John D. Godfrey, 1963. Scale 1:31 680. Accompanies Earth Sciences Report 61-2. (NTS 74M)
3. Geology of St. Agnes Lake District; John D. Godfrey and E.W. Perkert, 1963. Scale 1:31 680. Accompanies Earth Sciences Report 62-1. (NTS 74M)
4. Geology of Colin Lake District; John D. Godfrey and E.W. Perkert, 1964. Scale 1:31 680. Accompanies Earth Sciences Report 62-2. (NTS 74M)
5. Geology of Bayonet Lake District; John D. Godfrey, 1966. Scale 1:31 680. Accompanies Earth Sciences Report 65-6. (NTS 74M)
6. Geology of Ashton Lake District; John D. Godfrey, 1966. Scale 1:31 680. Accompanies Earth Sciences Report 65-2. (NTS 74M)
7. Geology of Potts-Charles Lake District; John D. Godfrey, 1966. Scale 1:31 680. Accompanies Earth Sciences Report 65-6. (NTS 74M)
8. Geology, Alexander Lake District; John D. Godfrey, 1978. Scale 1:31 680. Accompanies Earth Sciences Report 78-1. (NTS 74M)
9. Geology, Wylie Lake District; John D. Godfrey, 1979. Scale 1:31 680. Accompanies Earth Sciences Report 78-1. (three maps) (NTS 74M)
10. Geology of the Fort Chipewyan District, Alberta; John D. Godfrey, 1961. Scale 1:31 680. Accompanies Earth Sciences Report 78-3. (NTS 74M)
11. Bedrock Geology, Ryan Lake District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-2. (two maps) (NTS 74M)
12. Bedrock Geology, Fletcher Lake District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-2. (two maps) (NTS 74M)
13. Bedrock Geology, Bocquene Lake District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-5. (two maps) (NTS 74M)
14. Bedrock Geology, Turtle Lake District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-5. (two maps) (NTS 74M)
15. Bedrock Geology, Myers Lake District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-6. (two maps) (NTS 74M)
16. Bedrock Geology, Daly Lake District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-6. (two maps) (NTS 74M)
17. Bedrock Geology, Fitzgerald District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-7. (two maps) (NTS 74M)
18. Bedrock Geology, Tulip Lake District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-7. (two maps) (NTS 74M)
19. Bedrock Geology, Mercredi-Charles Lake District; John D. Godfrey et al., 1984. Scale 1:31 680. Accompanies Earth Sciences Report 84-7. (two maps) (NTS 74M)
24. Geology of the Marguerite River District, Alberta; John D. Godfrey, et al., 1984. Scale 1:63 360. (NTS 74E)
26. Geology of Red Deer and Rosebud Sheets; J.A. Allan and J.O. Sanderson, 1947. Scale 1:253 440. Accompanies Memoir 1.
28. Precambrian Geology of the Jasper Region; H.A.K. Charlesworth et al., 1967. Scale 1:250 000. Accompanies Bulletin 23. (NTS 83D)
29. Bedrock Geology of Northern Alberta; R. Green, M.A. Carrigy and G.B. Mellon, 1970. Scale 1:500 000, Two map sheets.
30. Geology of the Chinchaga River and Clear Hills (north half) Map Areas, Alberta; R. Green and G.B. Mellon, 1962. Scale 1:506 880. Accompanies Earth Sciences Report 62-8.
33. Bedrock Geology, Northwest-Central Alberta; G.B. Mellon, J.W. Kramers and E.J. Seagul, 1972. Scale 1:1500 000 (approximately). In Information Series No. 60, pp. 109-114.

Wilson, J. A. Basement Geology Beneath and Around the Western End of the Athabasca Basin, Alberta; Alberta Research Council, Open File Report, Scale 1:250 000.

2.4.2 Selected Bulletins

Geology of the Athabasca Group in Alberta; J.A. Wilson, 1985. ARC Bulletin No.49.

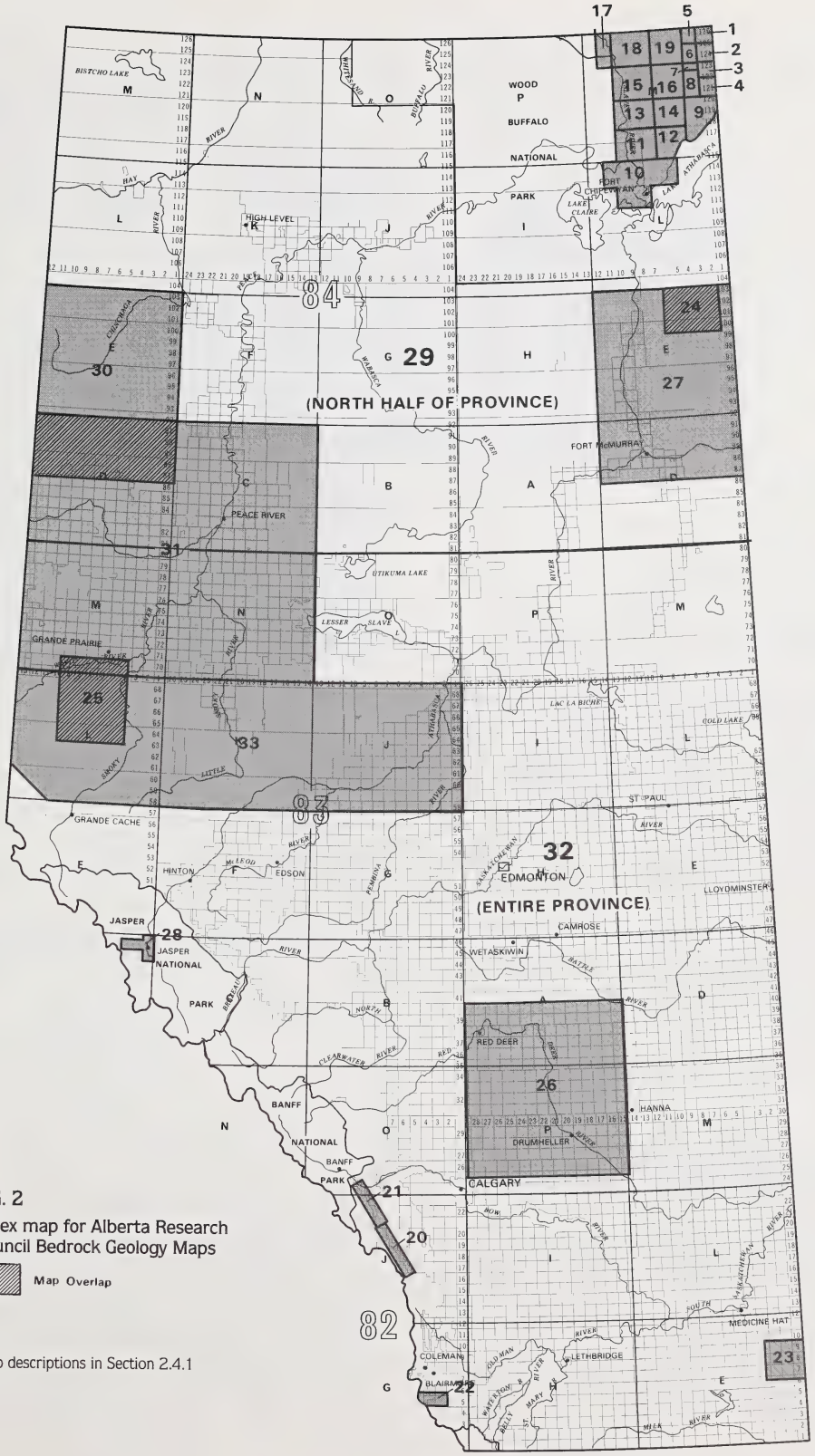


FIG. 2

Index map for Alberta Research Council Bedrock Geology Maps

Map Overlap

Map descriptions in Section 2.4.1

Alberta Geological Survey crew.

Polyphase Deformation in the Canadian Shield of Northeastern Alberta; C.W. Langenberg, 1983. ARC Bulletin No.45.

The Petrology and Geochemistry of the Canadian Shield and Northeastern Alberta; S.P. Goff, J.D. Godfrey and J.G. Holland: In Press.

The Geophysical Expression of the Canadian Shield of Northeastern Alberta; K.F. Sprenke, C.S. Wavra and J.D. Godfrey: In Press.

Geological reports and maps are available from:

Alberta Research Council
Publication Services
250 Karl Clark Road
Edmonton, Alberta, Canada
T0N 1E4

or mailing address:

Alberta Research Council
Publication Services
Box 8330, Station F
Edmonton, Alberta, Canada
T6H 5X2

Figure 2 shows the extent of detailed geological maps.

2.5 Bibliographic Data Base

The Alberta geoscience bibliographic data base, called GEODIAL, is sponsored and maintained by the Alberta Geological Survey of the Alberta Research Council and is available through the University of Alberta's computing services. It is the most comprehensive source of Alberta geoscience information and contains:

- All published and unpublished reports of the Alberta Geological Survey.
- A full index of assessment reports on Crown mineral dispositions.
- All GSC reports pertaining to Alberta.
- Theses from Canadian and international universities.

For information on individual searches, or any inquiries about GEODIAL, please contact:

Information Geologist
Alberta Geological Survey
Alberta Research Council
3rd Floor, Terrace Plaza
4445 Calgary Trail South
Edmonton, Alberta, Canada
T6H 5R7
Telephone: (403) 438-0555
Telex: 037-2147

2.6 Mineral Core Research Facility

The purpose of the facility is to collect and preserve geological data from mineral exploration in Alberta and to make this available to the public, industry and the scientific community. This diamond drill core selection and storage program was started by Alberta Energy and Natural Resources in 1979 for core recovered from exploration for metallic minerals. The submission of core data is required by the Metallic Minerals Regulation as part of the exploration approval conditions.

The core storage facility is currently located at the Central Core Storage Building, 11547-160 Street, Edmonton, Alberta. From the summer of 1986 it will be located at the Alberta Research Council Centre at 250 Karl Clark Road in Edmonton.

The data on public file consist of drill core, company-generated lithologs, downhole

Field core examination.

petrophysical logs and regional geochemical and geophysical surveys. The data on file currently relate only to the northeastern part of Alberta, specifically the Athabasca Basin, as a result of uranium exploration. In 1985, core from 99 holes drilled in the Athabasca Basin were on file. Eventually the facility will house mineral exploration data from all parts of Alberta.

The facility is administered by the Alberta Geological Survey. There is no charge for use of the facility but an appointment must be made.

Contact:

Alberta Geological Survey
Alberta Research Council
3rd Floor, Terrace Plaza
4445 Calgary Trail South
Edmonton, Alberta, Canada
T6H 5R7
Telephone: (403) 438-0555 and (403) 451-0057

2.7 Mineral Inventory Data

No comprehensive inventory files comparable to those in other provinces exist in Alberta at this time; however, a modern system will be implemented in stages within a few years. This data system will be compatible with that of other provinces, allowing ease of exchange on a national basis.

The inventory program will probably consist of three components:

1. Detailed site/area studies
   These studies will accommodate Integrated Resource Plans as well as specific disposition-related requests, etc. Each study is expected to be funded as a separate, short-term project.

2. Mineral Data Reports/Catalogue
   A Mineral Inventory Catalogue, for metallic minerals, will be published by Resource Evaluation and Planning Division of Energy and Natural Resources and the Geological Survey of the Alberta Research Council. This catalogue is arranged by mineral commodity and contains a bibliography and associated maps indicating location of reported occurrences. Specific details about each commodity are contained within the respective reports which are available from the Alberta Research Council.

   The catalogue containing information until 1985 is expected to be available for wide distribution January 1986. It will be updated on a regular basis.

   The report and catalogue activities will be maintained and used as a source for the Mineral Inventory Data Files.

   This catalogue will be available for public viewing at:

   Information Centre
   Alberta Energy and Natural Resources
   Main Floor, Bramalea Building
   9920 - 108 Street
   Edmonton, Alberta, Canada
   T5K 2M4

3. Mineral Inventory Data Files
   The long-term objective is to create detailed data files for use by the public and private sectors. This component of the total inventory program will depend upon the availability of resources such as manpower and funding.

4. Mineral Data Reports
   To date, one mineral data report for metallic minerals has been produced by the Alberta Research Council to complement the Mineral Inventory Catalogue. These reports include a preliminary summary of collected information about lead and zinc.

   Several other metallic minerals have been identified as priorities for inclusion into the Mineral Data Report series.

2.8 Alberta Remote Sensing Center

Satellite and aircraft multispectral imagery is readily available through the Alberta Remote Sensing Center in Edmonton. All interested persons in Alberta are encouraged to use the imagery and are given training or assistance in the application of the data. The Center is a branch of Alberta Environment, a department of the Government of Alberta.

The Center is service oriented. It leaves research to others. Its facilities are available free of charge to anyone — provincial, municipal and federal governments, agencies, schools and universities, private industry and the interested general public.

Interpretation Equipment

Specialized electronic and optical image interpretation equipment is available for use at the Center. Assistance is given in equipment application and operation. These services are free.

Imagery Library

A library of aircraft and satellite imagery of Alberta is maintained in the Center.

Alberta Remote Sensing Center

11th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta, Canada
T5K 2J6
Telephone: (403) 427-2381

Landsat 2 frame showing Lake Claire and the Peace/Athabasca Delta.

3. Management of Mineral Resources in Alberta

The Government of Alberta has been responsible for natural resource development since 1930. Alberta Energy and Natural Resources is responsible for administering the Mines and Minerals Act, which regulates all mining activity for metallic minerals in the province. The Metallic Minerals Regulation promulgated in 1984, was drafted in close collaboration with the Alberta Chamber of Resources.

This chapter describes the history of legislation related to metallic minerals and the present framework of legislation and administration. It also describes the roles of other government departments and organizations involved in metallic minerals exploration and development.

3.1 History of Mineral Rights and Minerals Legislation in Alberta

Alberta was settled later than other areas of Canada and differs somewhat in mineral ownership from other provinces.

During the early years of the nineteenth century, the mineral rights were granted together with the land. It was only in 1887 that the federal government passed a bill to reserve mineral rights in the name of the Crown when the land was sold or granted in homesteads. As a result, today approximately 75 per cent of minerals are reserved for the Crown and may be leased for exploration or development.

On October 1, 1930, the responsibility for and ownership of mineral resources within the province were transferred from the federal government to the Crown in right of Alberta. The 1982 amendment to the Constitution of Canada reaffirmed this reponsibility and clarified provincial ownership and jurisdiction over mineral rights within the province.

The present Mines and Minerals Act, Chapter M-15, with all amendments up to 1985, applies to all mines and minerals and related material vested in or belonging to the Crown in right of Alberta.

To enable the development of Crown minerals, mineral rights to specific locations are leased to companies or individuals through leasing agreements. An agreement grants the lessee exclusive rights to explore for and develop minerals in the granted location with specified conditions and with the requirement to pay the Crown a share of production and royalties.

3.2 Role of Alberta Energy and Natural Resources

Through the Mines and Minerals Act the department has a mandate to manage mineral resources in a manner which ensures their efficient development for the greatest possible benefit to the province and its people. ENR's role, relevant to metallic minerals, is to:

- formulate metallic minerals resource and revenue policies, recommend legislation and exercise ministerial discretion in administering the Mines and Minerals Act
- allocate the Crown's metallic minerals rights and administer the Crown's metallic minerals rights agreement
- distribute metallic minerals information to industry and the general public through appropriate agencies

3.3 Role of Other Departments

While ENR is most involved in regulating and providing services for the metallic minerals industry in Alberta, other government departments and provincial organizations are also involved. Some of these departments are involved in

approvals; some of them provide services that may assist the prospector or company in exploration and development.

Departments involved in metallic minerals exploration and development are:

Consumer and Corporate Affairs —
Corporate Registry for Alberta companies, associations, etc.

Economic Development —
business contacts, market development

Environment —
environmental issues, pollution control, standards and approvals

Labor —
employment standards

Manpower —
employment development

Municipal Affairs —
property assessment, municipal planning and improvement districts

Tourism and Small Business —
assistance to small business

Transportation —
regional transportation, transportation safety

Treasurer —
corporate tax administration

Workers' Health, Safety and Compensation —
occupational health and safety, mine trade certification

3.4 Alberta Chamber of Resources

This industry association with 187 members has represented resource sector private enterprise in the province for over 50 years. During this period the Alberta Chamber of Resources (ACR) has supported resource and industrial development in Alberta and the Northwest Territories.

The ACR presents industry views and opinions to the public and government in an attempt to influence policy and decision makers.

The ACR sponsors surface mine safety activity and maintains a 15-year tradition as the host of mine management meetings.

The ACR contracts management services to the Consulting Engineers of Alberta and the Construction Owners Association of Alberta.

At ACR's head office there are conference facilities and temporary office accommodation for members. The office is located at:

Alberta Chamber of Resources
1410 Oxford Tower
10235 - 101 Street
Edmonton, Alberta, Canada
T5J 3G1
Telephone: (403) 420-1030
Telex: 037-2966

4. Exploration

Ground geophysical prospecting in northeastern Alberta.

4.1 Prospecting and Geophysical Surveys

Prospecting by hand tools for Crown minerals, without surface disturbance, is permitted throughout Alberta without any licence, permit or regulatory approval. It is understood that prospectors must receive consent from the surface owner or occupant. Unoccupied public lands may be explored without restriction but prospectors working in remote areas are advised, for their own safety to inform the local forestry officer.

While prospecting, the prospector may travel in a vehicle on a previously established road, trail or existing cut-line and may occupy a tent, trailer or other shelter at any location for not more than 14 days.

Airborne geophysical surveys, geochemical surveys and ground geophysical surveys that do not disturb the land or vegetation cover are permitted without any exploration permit.

4.2 Exploration Regulations

When exploration requires any land disturbance or use of heavy exploration equipment, the prospector or company is required to obtain appropriate approvals and permits. For most projects, three steps are required:

1. exploration licence
2. exploration permit
3. exploration approval

The following sections describe the criteria and procedures for each step. Figure 3 outlines these procedures in a flow chart.

4.2.1 Exploration Licence

Any company or person for whom an exploration project is carried out must obtain an exploration licence before starting the project (Figure 3 and Table 1). Applications may be obtained from the Exploration Branch of Alberta Energy and Natural Resources.

The application must be accompanied by a deposit of $1 000 which is returned upon performing the work in compliance with exploration approvals. This province-wide licence is not time limited, but remains in effect as long as the company is operating in Alberta.

4.2.2 Exploration Permit

Any company or person wishing to operate exploration equipment (such as a seismic truck or a drilling rig), must obtain an exploration permit under the Exploration Regulation A.R. 423/78 (Figure 3 and Table 1).

Application forms may be obtained from the Exploration Branch of Alberta Energy and Natural Resources.

The application must be accompanied by a deposit of $1 000 which is returnable upon performing the work in compliance with exploration approvals. This province-wide permit is not time limited, but remains in effect as long as the company is operating in Alberta.

TABLE 1

Summary of Exploration Regulatory Documents

	Issued To	Purpose	Apply to
Exploration Licence	Company or person wanting to explore	Province-wide permission to explore for metals	Exploration Branch Alberta Energy and Natural Resources 9915 - 108 Street Edmonton, Alberta Canada T5K 2C9
Exploration Permit	Company or person wanting to operate equipment (often a contractor hired by exploration company)	Province-wide permission to operate exploration equipment	
Exploration Approval	Company or person wanting to explore	Site-specific permission to conduct exploration which involves environmental disturbance	

4.2.3 Exploration Approval

Any exploration project that involves environmental disturbance such as drilling, trenching or bulk sampling must receive approval. The exploration licensee does not need to hold mineral rights to apply for an exploration approval, but where metallic mineral rights have been granted, it is not anticipated that approval of drilling, trenching and bulk sampling would normally be given to other than the agreement holder.

The project approval is administered by the Exploration Branch of Alberta Energy and Natural Resources which refers the application to the Department of Environment, and to the Public Lands and Forest Lands divisions of Alberta Energy and Natural Resources. The application must fully describe the location and methods of exploration. It will be processed within 10 working days of the receipt of the application.

The application for exploration approval must include the following information:

1. Minerals sought in exploration.
2. Type of equipment to be used.
3. Expected commencement and completion dates of the program.
4. Names and addresses of the licensee and permittee (the permittee is usually the contractor who performs the field work).
5. Map showing the area to be explored, with the complete land description and the location of all existing and proposed lines, roads, creek crossings and any land disturbances.

Following submission of an exploration program and receipt of exploration approval, the prospecting or mining company may conduct the approved exploration activity. However, an applicant must obtain prior approval for any deviations from the approved program.

Within 60 days of the completion of the exploration program, a final plan must be submitted to the Exploration Branch, showing the actual program conducted in the field. This must include a map showing the location of drilling test samples, roads built for the exploration and all land disturbances.

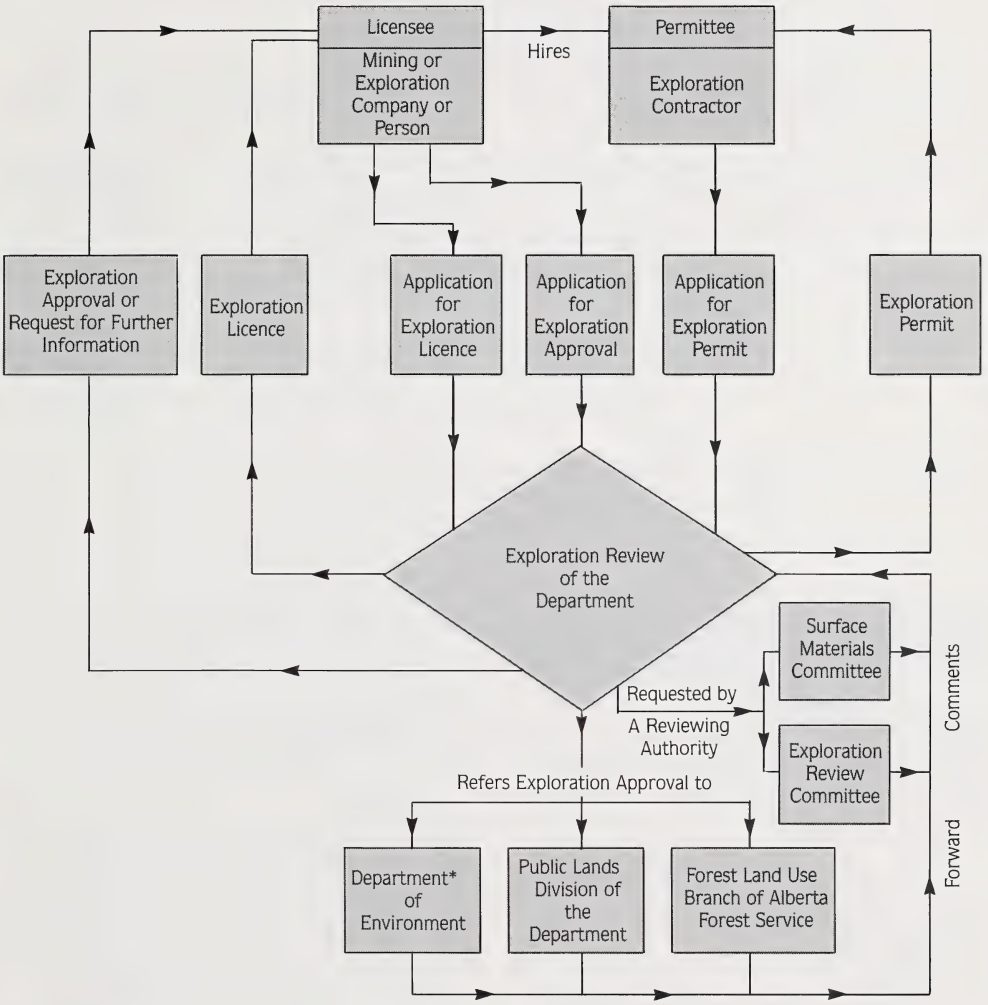
Figure 3 shows a flow chart of regulated activity.

4.3 Exploration for Uranium

Although uranium resources are fully under Alberta's provincial jurisdiction and are subject to all conditions applicable to metallic minerals, the Atomic Energy Control Board (AECB) also administers approvals for exploration for uranium pursuant to the Atomic Energy Control Act and Regulation.

FIG. 3

Administration of Regulated Exploration Activity



* For an exploration program that will involve the use of
(a) the bed or shore of a permanent watercourse
(b) water body or land within one kilometre of a dam

Prospecting

No permission from the board is required to prospect for uranium or thorium. However, a person finding a deposit containing more than 0.05 per cent by weight of uranium or thorium is required to report the discovery to the Geological Survey of Canada (GSC) in Ottawa.

The prospector may protect a discovery by applying for a Metallic Minerals Exploration Permit to the Minerals Agreements Branch of Alberta Energy and Natural Resources (refer to section 5.1). After reporting to GSC, the prospector is free to make the discovery public.

Detailed Exploration Work

A person or company intending to carry out detailed exploration work for uranium and thorium (such as extensive surface work, diamond drilling, test pitting or preliminary underground work) is required to obtain a uranium exploration permit from the AECB. The application must contain a description of the mineral rights agreement (see chapter 5) and the proposed work.

5. Mineral Rights Acquisition

Any person or company may secure rights to metallic minerals by obtaining a Metallic Minerals Exploration Permit for the desired location. This permit is granted under the Mines and Minerals Act. The conditions under which it may be held are governed by the Metallic Minerals Regulation (A.R. 246/84).

To develop or recover metallic minerals a prospector or company must obtain a Metallic Minerals Lease. The payment of royalty is provided by the Metallic Minerals Royalty Regulation (A.R. 253/85).

The following sections outline the requirements and procedures to obtain the Metallic Minerals Exploration Permit and the Metallic Minerals Lease.

5.1 Metallic Minerals Exploration Rights

There is no provision for a prospector or company to stake a claim on the ground. Rather, an exclusive location is secured upon application for a Metallic Minerals Exploration Permit. The application should be made to:

Mineral Agreements Branch
Alberta Energy and Natural Resources
South Petroleum Plaza
9915 - 108 Street
Edmonton, Alberta, Canada
T5K 2C9

The application must give the desired location and be accompanied by a fee of $25 and by a deposit of $10 per hectare for the number of hectares in the location. The deposit may be as cash, a letter of credit, negotiable bearer bonds or promissory note. The deposit is returned after the required assessment work has been satisfactorily completed.

The initial term of the permit is three years. The permit is renewable for a period of two years, and for a further two periods of one year each, making the total life span of a permit seven years.

The maximum area of a permit is 9 216 hectares (one township) and the minimum is 16 hectares (one legal subdivision). Any person or company may hold more than one exploration permit.

Assessment Requirements

A permittee is required to spend the following amounts on assessment work on the location of the permit:

- $10 per hectare during the initial term
- $30 per hectare during the second term
- $15 per hectare during each of the last two terms

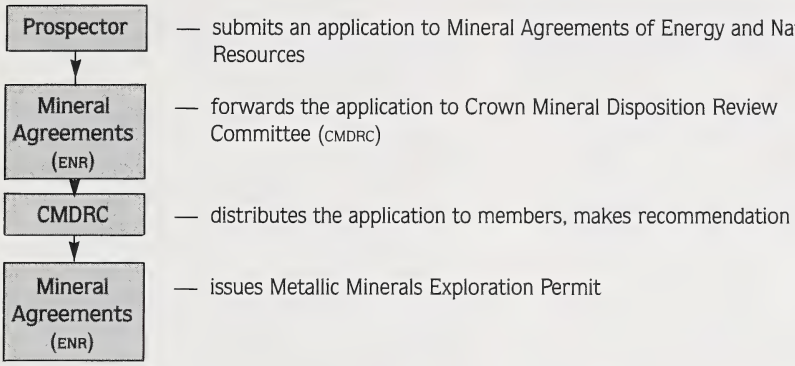
A permittee may apply to have any amount above the minimum spending requirements transferred to any remaining terms of the permit or to any year of the primary term of the lease.

A report on the assessment work for each term must be submitted before the end of the term. The report must contain a description of the results of work conducted and an itemized statement of expenditures. The report must be certified by a professional engineer, professional geologist, professional geophysicist or the prospector, and the declaration of expenditures must be made under oath. The fee for the recording of the report is:

- $100 for the initial permit term
- $200 for the first renewal term
- $250 each for the second and third renewal terms

The assessment report is kept confidential for one year after the expiry of the term, after which it is put on an open file of the Alberta Geological Survey of the Alberta Research Council.

FIG. 4
Metallic Minerals Exploration Permit Procedure
Summary of Mineral Rights Documents


Prospector
— submits an application to Mineral Agreements of Energy and Natural Resources
Mineral Agreements (ENR)
— forwards the application to Crown Mineral Disposition Review Committee (CMDRC)
CMDRC
— distributes the application to members, makes recommendation
Mineral Agreements (ENR)
— issues Metallic Minerals Exploration Permit

A permittee may be requested to submit core samples from the locations to a core storage facility in Edmonton. The costs of selecting and transporting the samples are borne by the permittee. If circumstances warrant, the requirement of core submission may be waived.

If the assessment work and the report are satisfactory, the term of the permit may be renewed or a lease application accepted and the deposit will be returned. Where the permittee does not carry out work and/or the report is unsatisfactory, the permit may be cancelled and the deposit forfeited.

Public Offering

Alberta Energy and Natural Resources may offer Metallic Minerals Exploration Permits, for an area that was previously withdrawn from disposition, for public competitive tendering. The department would invite bids in the form of refundable work deposits.

The refundable work deposit may be in the form of cash, a letter of credit, negotiable bearer bonds or promissory note. The deposit is held for the term of the permit and, if appropriate, for the term of the lease that is issued out of a permit.

The deposit is refunded after the required assessment work is completed.

5.2 Metallic Minerals Leases

A permittee who has complied satisfactorily with the terms and conditions of the Metallic Minerals Exploration Permit may apply for a Metallic Minerals Lease for all or part of the location of the permit. A lease grants the exclusive right to recover the Crown metallic minerals within the lease location.

The application for a lease should be made to:

Mineral Agreements Branch
Alberta Energy and Natural Resources
South Petroleum Plaza
9915 - 108 Street
Edmonton, Alberta, Canada
T5K 2C9

The application should be accompanied by a fee of $50 and annual rental of $2.50 per hectare.

The primary term of the lease is 10 years. The lease is renewable for as many terms as may be required of 15 years each, subject to any condition which might be prescribed at the time of the renewal.

Assessment Requirements

During the primary term of the lease, the lessee must spend a minimum of $10 per hectare per year in exploration and development of the lease and must report on such assessment work annually. The excess of work expenditures may be transferred to subsequent years. This mandatory assessment work stops when a commercial project approval is obtained, or the minister may waive the obligation in certain circumstances.
The assessment work is kept confidential for one year from its registration, unless the lessee requests the information be kept confidential for a longer period, after which it is put on an open file of the Alberta Geological Survey.

Grouping of Leases

For the purpose of assessment work or refundable work deposit, a lessee may group two or more leases providing the leases are touching each other or are not separated by more than two kilometres from each other.

The total area covered by a group of leases must not exceed 9 216 hectares.

A group of leases may be cancelled if the lessee fails to comply with requirements or it may be terminated or amended upon request by the lessee.

5.3 Metallic Mineral Agreements Disposition Maps

In order to provide the public with accurate information on mineral rights agreements, the department produces a set of Metallic Mineral Rights Disposition maps at a scale of 1:50 000. Each map sheet is 80.5 cm x 89 cm and conforms to the boundaries of the National Topographic System (NTS). There are 16 maps in the series.

Basic Information

The maps depict the following:

- Township, range and meridian
- Topographic and major hydrographic features
- Major man-made features

Metallic Mineral Rights Information

Each sheet contains the following information:

- Sheet Reference Number
- Metallic Minerals Exploration Permit — granted and applications, permit number and name of permittee or applicant
- Metallic Minerals Lease — Number and name of lessee
- Quartz Mineral Lease, Certificate of Record — Number and name of lessee — (Rights previously granted under the Quartz Mining Reg.)
- Registered rights of first refusal for compensated agreements
- Freehold metallic minerals
- Minerals withdrawn from disposition
- Natural Area/Ecological Reserves
- Surface access restrictions
- Integrated Resource Management Plan Boundaries and Zones

Availability

Diazo copies of the maps can be obtained at a cost of $4 per sheet through:

Alberta Energy and Natural Resources
Minerals Support Branch
12th Floor, South Petroleum Plaza
9915 - 108 Street
Edmonton, Alberta, Canada
T5K 2C9
Telephone: (403) 427-7704

or orders will be accepted at:

Alberta Energy and Natural Resources
Calgary Office
John J. Bowlen Building
620 - 7th Avenue S.W.
Calgary, Alberta, Canada
T0P 0Y8
Telephone: (403) 261-6324

National Topographic Maps and Air Photos are available from:

Distribution Services
Alberta Bureau of Surveying and Mapping
Alberta Energy and Natural Resources
2nd Floor, North Petroleum Plaza
9945 - 108 Street
Edmonton, Alberta, Canada
T5K 2G6
Telephone: (403) 427-3520

Updating

Each map sheet incorporates a revision date in the legend. The original film copies are updated and maintained by the Minerals Support Branch of Alberta Energy and Natural Resources. For this reason stock copies are not maintained, but diazo prints can be produced upon request weekdays from 8:15 a.m. to 4:30 p.m. at the Edmonton office. Requests received in the Calgary office by noon will be available for pick-up by noon of the following working day at that office.

In addition, both offices maintain a current set of maps for public viewing.

Information regarding metallic mineral activity which might have taken place after the revision date of a map may be obtained from the Mineral Agreements Branch, Telephone (403)427-7712. Township searches will continue to be issued where specifically requested.

5.4 Surface Rights

The exploration permittee or a developer must obtain a consent of the surface owner or, where the surface owner is the Crown, a Mineral Surface Lease (MSL) granted under the Public Lands Act, the Mineral Surface Lease Regulation (A.R. 228/58). The MSL issuance is administered by the Public Lands Division of Energy and Natural Resources located at the address below.

The agreement of sale with, or the consent for use by the private owner is generally reached in most cases by a direct negotiation of a payment. The disputed payment may be referred to arbitration by the Surface Rights Board (SRB). The board settles disputes between the developer or permittee and a land owner over the payment, however the SRB will not act unless the government has already approved the project affecting the land.

Public Lands Division
Alberta Energy and Natural Resources
3rd Floor, South Petroleum Plaza
9915 - 108 Street
Edmonton, Alberta
T5K 2C9
Telephone: (403) 427-3498

6. Development

6.1 Development Approval

To develop a mine site, a lessee must obtain an authorization by the Lieutenant Governor in Council. The approval process involves numerous steps, summarized as follows (Figure 5):

Preliminary Disclosure Approval
For a major development, a preliminary disclosure must be submitted on a confidential basis to the Government of Alberta via the Resource Evaluation and Planning Division of Alberta Energy and Natural Resources. Through the preliminary review, the government indicates whether it agrees or has objection in principle to the development proposal, timing or location.

Consent in principle to a major development does not constitute final approval. Additional applications must be filed.

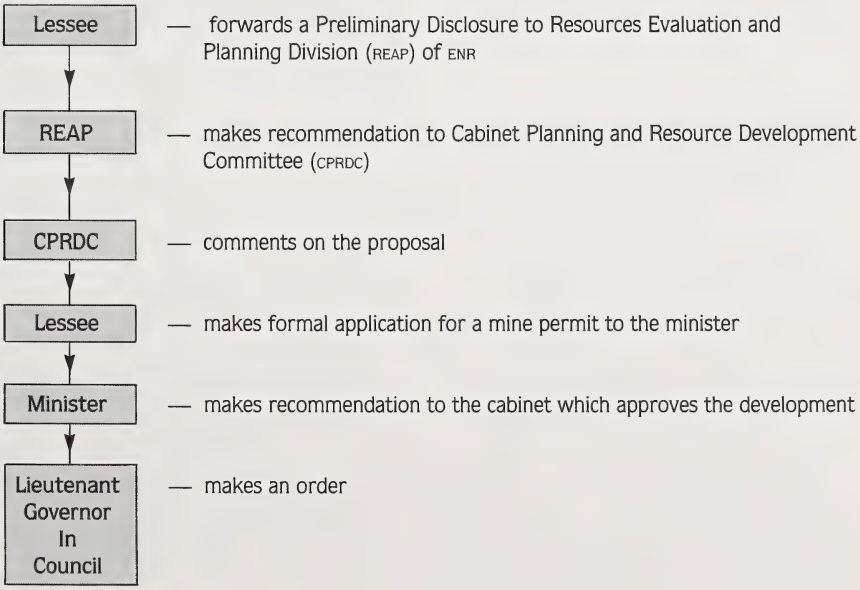
Mine Permit
Application for a mine permit must be submitted to the Minister of Energy and Natural Resources. In certain instances, a public disclosure will be required before a mine permit is granted. The application must contain:

1. general outline, including a general statement concerning marketing plans, rate of extraction, transportation and manpower allocation
2. photomosaic or topographical map
3. geological report with evaluation or reserves
4. mining plan
5. air quality report
6. hydrogeology report
7. surface disturbance report
8. reclamation plan

To simplify approvals by other departments, the following documents should be included with the application:

1. development and reclamation (D&S) application
2. environmental impact assessment (EIA)
3. economic assessment
4. historical resources impact assessment (HRIA)
5. transportation impact assessment (TIA)

FIG. 5
Mine Development Approval Procedure


Lessee
— forwards a Preliminary Disclosure to Resources Evaluation and Planning Division (REAP) of ENR
REAP
— makes recommendation to Cabinet Planning and Resource Development Committee (CPRDC)
CPRDC
— comments on the proposal
Lessee
— makes formal application for a mine permit to the minister
Minister
— makes recommendation to the cabinet which approves the development
Lieutenant Governor In Council
— makes an order

The above components are forwarded by ENR to the appropriate agencies for approval:

1. The Land Surface Conservation and Reclamation Council must approve the Development and Reclamation (D&R) application.
2. Department of the Environment must approve:

   Water resource permit to drain or depressurize any aquifers, or to undertake any activity in or adjacent to a watercourse or waterbody that may affect those waters, and a licence to operate works to divert and use water.

   Clean water permit to construct, and a licence to operate, any facility that would use water.

   Clean air permit to construct, and a licence to operate, where the proposed facility or the use of an access and haulage road is capable of releasing particulate or chemical matters into the atmosphere.
3. Mines Inspection Branch of the Workers' Health, Safety and Compensation Department sets and enforces standards of health and safety through the Occupational Health and Safety Act.

6.2 Uranium Mine

Before obtaining provincial approval for a uranium mine as outlined in section 6.1, the company or individual must obtain a mining permit from the Atomic Energy Control Board. Sales of uranium or thorium concentrates can be made only to persons authorized by the AECB to receive such materials.

6.3 Metallic Mineral Royalty

The Metallic Minerals Regulation royalty regime, developed in close consultation with the Alberta Chamber of Resources and promulgated in the fall of 1985, embodies the principles of minimum Crown royalties for mineral resources and the need for an equitable return to the successful developer.

Fiscal Regime

The royalty rates are structured to recognize the typically capital intensive nature of metallic mining. They permit lessees to recover their allowable costs prior to full participation by the Crown. In brief, the regime employs:

a) 1% mine mouth royalty from commencement of operations until payout is achieved and as a minimum annual royalty thereafter, and

b) 12% net royalty (revenue minus allowable costs) after payout, subject to the above minimum.

The regime is based on the production, recovery and sale or other disposition of metallic minerals produced from Alberta Crown lands and recovered through a single mine.

Payout occurs the day on which the sum of the cumulative allowed costs, cumulative on-site exploration and development costs, cumulative annual capital allowance and culmulative pre-payout royalty equals the cumulative gross revenue.

Tenure

Where the month of first sale of a leased substance in respect of a Metallic Mineral Lease occurs before January 1, 1986, the royalty payable to the Crown in each month of the 10-year period following the month of first sale will be the royalty prescribed above.

Information

For further information, obtain a copy of *Metallic Minerals Royalty Guidelines* from:

Information Centre
Alberta Energy and Natural Resources
Main Floor, Bramalea Building
9920 - 108 Street
Edmonton, Alberta, Canada
T5K 2M4
Telephone (403) 427-3590

7. Land-Use Administration, Environmental Protection

7.1 Crown Minerals Disposition Review Committee

In the early 1970s, the Government of Alberta proclaimed the Land Surface Conservation and Reclamation Act in order to protect the environment and to regulate activities related to exploration for and development of natural resources. Following the act, the Land Conservation Regulation was passed establishing the Crown Mineral Disposition Review Committee (CMDRC).

The committee membership consists of employees of the following government agencies and departments appointed by the Lieutenant Governor in Council:

Agriculture
Business Development and Tourism
Energy and Natural Resources
Environment
Municipal Affairs
Recreation, Parks and Wildlife
Transportation
Energy Resources Conservation Board
Research Council of Alberta

The Forest Land Use Branch of Energy and Natural Resources forwards to this committee all applications for mineral rights dispositions, including Metallic Minerals Exploration Permits and Leases.

Upon review of a mineral disposition, the CMDRC may recommend to the Minister of Energy and Natural Resources that the proposed disposition be granted with or without special terms or conditions, or be refused and the minerals withdrawn from disposition.

Where the minister or the authorized officer is not satisfied with a recommendation, the matter may be sent for further review to the Natural Resources Co-ordinating Council.

7.2 Policy for Resource Management of the Eastern Slopes

In response to the increased pressure on land and the need to co-ordinate multiple uses of resources, in 1977 the government announced a Policy for Resource Management of the Eastern Slopes. This policy, which was updated in 1984, ensures that all public lands and resources are protected, managed or developed according to a philosophy of integrated resource management. The policy presents the Government of Alberta's resource management policy for the public lands and resources within the region. It is intended to be a guide to resource managers, industry and public having responsibilities or interests in the area rather than a regulatory mechanism.

The Eastern Slopes Policy establishes land use zones where metallic minerals activity is

classified to be permitted, restricted or prohibited within the defined Eastern Slopes Boundary. Development is not permitted in the Prime Protection and Facility zones; is permitted with certain conditions in the Critical Wildlife, Special Use and General Recreation zones; and is fully compatible in the Multiple Use, Agricultural and Industrial zones.

Copies of the policy with map sheets at a scale of 1:500 000 are available at:

Information Centre
Alberta Energy and Natural Resources
Main Floor, Bramalea Building
9920 - 108 Street
Edmonton, Alberta, Canada
T5K 2M4

7.3 Integrated Resource Plans

In the early 1980s, the government started a system of detailed Integrated Resource Plans to allocate use of public lands and resources.

Planning is co-ordinated by the Resource Evaluation and Planning Division of Alberta Energy and Natural Resources. Plans for specific areas are developed by teams made up of resource managers with responsibilities for land management, consultants, interested groups, and individuals involved in public involvement programs. Upon approval by a provincial cabinet committee, the plan becomes the Government of Alberta's statement of resource management direction for the planning area.

7.4 Referral Review

A request for a change of zoning for the purpose of exploration or development of metallic minerals may be accepted by the Resource Evaluation and Planning Division. The requested location is recorded by the Mineral Resources Division as an application for exclusive mineral rights; however, applications are not processed until the rezoning decision is made.

Where the application for rezoning is approved, the mineral rights are granted to the applicant; where rejected, the application is returned.

7.5 Compensation

Occasionally the planning process may result in prohibitions of further development of a metallic mineral in a location where a Metallic Minerals Exploration Permit or Lease has already been granted. In these cases, the holder of the permit or lease may receive compensation under the Mineral Rights Compensation Regulations in return for surrendering the mineral rights agreement. The compensation consists of all expenditures incurred during exploration and development, fees, rental and interest allowance.

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